



Munich Personal RePEc Archive

Spatial and scenario analyses of long distance coach transport in Italy.

Paolo Beria and Raffaele Grimaldi and Andrea Debernardi
and Emanuele Ferrara and Antonio Laurino

DASStU - Politecnico di Milano, Studio META

2014

Online at <http://mpra.ub.uni-muenchen.de/54739/>

MPRA Paper No. 54739, posted 27. March 2014 14:55 UTC

Spatial and scenario analyses of long distance coach transport in Italy.

Beria Paolo,¹ Grimaldi Raffaele,^{1*} Debernardi Andrea,² Ferrara Emanuele,² Laurino Antonio¹

¹ DASTU – Politecnico di Milano, Milan, Italy

² Studio META, Monza, Italy

* Corresponding author:

Grimaldi Raffaele, raffaele.grimaldi@polimi.it, DASTU – Politecnico di Milano, Via Bonardi 3, 20133, Milano – Italia

Abstract

In Italy long distance coach services have long played a significant role in connecting the most dispersed part of the country to major destinations, giving an important contribution to social and geographical inclusion, but remaining limited in absolute numbers and receiving marginal attention by the general public and even policy makers.

After years of stability, the industry is going to face radical changes in the next years since its liberalisation process, gradually started in 2007, was completed at the end of 2013, changing from exclusive concessions to non-exclusive authorisations.

In this paper we perform some spatial and scenario analyses, with particular reference to competing transport modes and new potential markets.

The industry supplied more than 88 million bus-km in 2012, serving about 2.6 billion passenger-km. The existing network, providing a particularly extensive service in the South and in the Centre of the country, directly serves 2/3 of Italian population.

New opportunities are arising as a consequence of liberalisation, changes in competing modes (in particular long distance railway services) and changes in characteristics of part of the country also as a consequence of more recent internal migration phenomena.

Coach services in 2013 are serving only 27,000 origin-destination, including indirect connection, out of about 115,000 formally allowed. Many relations, including some very important in terms of total mobility, are still unexplored and left to competing transport modes (rail and air).

Our analyses suggest that the most promising relations for possible new services appear to be those among the Centre and the North-East of the country, with a polarisation on urban areas having limited rail services.

JEL classification: R, R40.

Keywords: coach, bus, intercity, long distance, express, highway, public transport, transport planning, Italy

1. Introduction

In Italy long distance coach services have long played a significant role in connecting the most dispersed part of the country to major destinations, giving an important contribution to social and geographical inclusion, but remaining limited in absolute numbers and receiving limited attention by the general public and even policy makers.

After years of stability, the industry is going to face radical changes in the next years since its liberalisation process, gradually started in 2007, was completed at the end of 2013, changing from exclusive concessions to non-exclusive authorisations.

This report presents the results of a research project carried out, on behalf of ANAV,¹ by the *Research Centre on Transport Policy TRASPOL*² of DASTU – Politecnico di Milano, with the modelling support of *Studio META*.³ The objective of the present work is to analyse existing services at an unprecedented level of detail, updating the former research carried out in 2011 (Beria *et al.*, 2012; Beria *et al.*, 2013), by means of a national long distance transport model including four transport modes (coach, rail, air and private transport) and the related infrastructure, and suggesting possible new markets.

In section 2 we analyse the industry and its regulation; section 3 described the new national multimodal transport simulation model; section 4 analyses the existing supply of long distance coach transport in Italy and provides the first detailed representations; in section 5 we perform spatial analyses of the Italian of the current long distance services supply to evidence missing connections and possible potential markets; section 6 provide scenario analyses made using the transport model to test the effect of changes in other modes on long distance coach transport e suggest the most promising new relations; final considerations are provided in section 7.

2. The industry and its regulation

The industry has been already introduced and analysed in former research papers and reports (Beria *et al.*, 2012; Beria *et al.*, 2013), outlining its peculiar characteristics, the role played also in terms of social and geographical inclusion and the perspectives of consolidation and expansion of the market.

In the period 2007-2013 the sector was gradually liberalised, changing from a concession regime (basically granting local geographical monopolies to historical incumbent operators)⁴ to an open one, based on non-exclusive authorisations.

The definition of long distance services changes a lot among different European countries (Beria *et al.*, 2013; Van de Velde, 2009). In Italy those services, which are responsibility of the State and are now fully liberalised, are indicated by Italian laws (*Legislative Decree 285/2005*) as “*services operated on paths linking more than two regions.*” This means that services connecting only two regions are responsibility of the Regions and thus still regulated by concessions, that is they are not liberalised.

As outlined by Beria *et al.* (2013), in other European countries regulation differs significantly: for example, the industry is completely deregulated in Great Britain, substantially deregulated in Sweden and Norway, regulated under concessions in Spain and very limited in France, where only cabotage of some national passengers (no more than half) on international services is allowed.

¹ ANAV, “Associazione Nazionale Autotrasporto Viaggiatori” (www.anav.it);

² www.traspol.polimi.it

³ www.metaplanning.it

⁴ Origin-Destination pairs already served by existing operators used to be protected from competing services in a radius of 30 km from either the origin or the destination.

In Germany the industry was instead completely deregulated since 1st January 2013, after decades of substantial absence of services. According to Augustin (2013), the result was a boom in the supply of services, which doubled in the first six months of the year. Also the effect in terms of passengers is important, increasing by 9% in the first four months of 2013 with respect to the same 2012 period. The market is mostly made of medium or small-sized companies, often in partnership or collaboration under common brands to show the supply on the market through single selling platforms (e.g. *Flixbus* or *Deinbus*). Moreover, bigger firms outsource services to smaller local companies, under their commercial brands.

3. A new multimodal long distance national transport model

In order to better analyse the existing supply, we developed a multimodal long distance national transport model for Italy.

The model, based on a sub-provincial detail level including 371 zones (**Figure 1**), is capable to:

- Describe the multimodal infrastructure network (roads and motorways, railways, ports and airports);
- Simulate intermodal choices, modelling the integrated medium to long distance transport service timetable (air, rail and coach services);
- Estimate the expected mode shares, for each origin-destination pair, of private transport and of the different segments of public transport (air, rail and coach services).



Figure 1 - Zones of the national transport model.

The model was developed by Studio META in partnership with TRASPOL. As shown in **Figure 2**, the model currently is made basically of a *supply module* and a *mode choice module*.

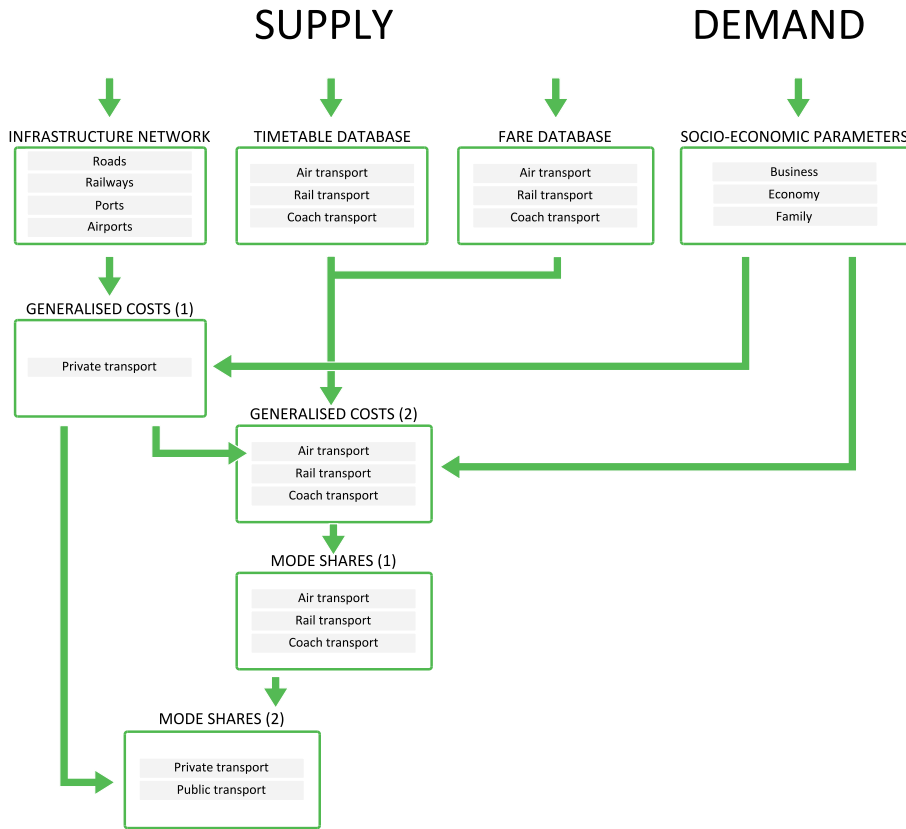


Figure 2 – General structure of the Italian multimodal transport model.

The supply module includes:

- a *multimodal graph* describing the Italian transport infrastructure (rail network, road network, ports and the main maritime navigation routes, airports and air navigation routes);
- a *timetable database*, including the complete air and rail transport timetables, main ferry service timetables and long distance coach transport timetables;⁵
- a *hypergraph of public transport services*, linking together the timetable database and the multimodal graph;

In addition, the model includes some fares functions, linking the fare with the relevant parameters (competition level, distance travelled and/or advance of purchase). Fares are differently modelled for the different users profiles, so that business users pay full fares, economy users take advantage of discounted/advanced fares and family users can benefit from both discounted/advanced fares and/or family/children fares.

Such module allows to estimate matrices of travel time, operating costs and fares for each origin-destination pair within Italy and for each transport mode, determining the associated generalised cost for three user profiles (*business*, *economy* and *family*) having different values of travel time, private car availability (and consequent related marginal costs), size of the travelling group and average stay in the place of destination.

Air and rail transport are integrated with simplified (i.e. parametric) auxiliary access and egress modes: public transport for economy users, private car (access) and rented car (egress) for business and family users.

⁵ The database includes 12 air companies (6 low cost and 6 full service) operating 1,300 routes, 2 rail companies (Trenitalia and NTV) operating 523 services on an average week day and 40 coach companies operating 620 services on an average week day.

Private transport is integrated with ferries to allow the connection of the main islands. Coach transport is modelled without any access or egress mode, that is users are expected to use this mode only if their origins and destinations belong to a zone directly served by this transport mode.

Expected travel choices are simulated in the mode choice module using a two-levels nested logit discrete choice model: a first choice between public and private transport and a subsequent public transport choice among air, rail and coach transport.

4. Analysis of the existing long distance coach transport supply

Data for actual long distance services was made available by 27 ANAV companies out of 44 companies, totalling 55.8 million km in 2012. We estimated through our database and published timetables at least 32.16 million km supplied by remaining companies. This considers only non-seasonal services, so that no less than 87.9 million km of long distance services were supplied in 2012.

Data on passengers per line were made available by the same dataset of companies. Most of the coach lines exercised today (86%) are used by less than 50,000 passengers per year; 10% count up to 100,000 passengers and just 4% are the most crowded lines with more than 100,000 passengers. This clearly shows how coach transport is limited to minor connections, namely between secondary cities or between sparse origins with main cities. For a rough comparison, out of 150 domestic air routes in Italy in 2011, 112 registered more than 50,000 passengers and only 38 less.⁶

Yearly patronage per line	
Less than 10,000 passengers per year	33%
10,000 to 50,000 passengers per year	53%
50,000 to 100,000 passengers per year	10%
More than 100,000 passengers per year	4%

Table 1 – Patronage data on coach lines in Italy (ANAV, data 2012).

As a first step, we draw the first detailed representations of existing long distance coach services and perform some spatial analyses of supply. Long distance coach services in April 2013 are represented in Figure 3 (representation of service flows) and Figure 4 (representation of services at stops).

Figure 3 shows how extensive the network is in Southern Italy, with many direct services even from smaller towns towards the most important destinations. Most services connect Puglia, Basilicata, Calabria and Sicily with Rome and Naples, as well as with the Northern cities, usually with night buses. Many services serve the Adriatic coast, connecting it in particular to Rome crossing the Apennine Mountains.

Figure 4 shows that stops are spread across the whole South, in particular on the regions of Adriatic coast. In the Centre and in the North, services are instead concentrated in the main cities and never connecting small towns or villages. Rome is served by the highest amount of services, but Siena (Tuscany) and many medium or small towns in the South are served by a surprisingly high number of services. This can be explained with the historical lack (or marginality) of rail services, both regional and long distance, serving those destinations.

The situation in Northern Italy is the opposite and somehow surprising, considering the high density of inhabitants: there are very few services, many important towns have no services at all and most of them represent connections towards the South or the Centre. Almost no services connect Northern localities. To the contrary in the South and in part of the Centre, there are many services notwithstanding the low population: almost all towns, even the smallest, are served. Services are both connections to the North and the Centre and within the South itself, often substituting non existing or non competitive rail services.

⁶ Our elaborations on ENAC data.

In Table 2 we suggest a more thorough analysis of the characteristics of services in some areas of the countries.

Areas	Characteristics of services
Calabria (in particular the Ioniaian coast)	Extensive land coverage
Marche (Adriatic coast)	Many stops, having similar and high frequencies
Val d'Aosta	
Puglia	Extensive land coverage Hierarchy of stops, with clearly recognisable poles
Umbria	Services focused on main corridors, with feeder services
Northern Italy	North-South services focused on main corridors Only main cities connected
Lazio	Many services to everywhere, but concentrated only in Rome (and in some cases also its airports). No services elsewhere.
Veneto	Few or no services, usually with the South
Friuli-Venezia Giulia	
Trentino-Alto Adige	No services
Sardinia	

Table 2 - Characteristics of services and relative areas.

Figure 6 shows air and long distance rail transport services. If we compare the long distance coach (Figure 3) and rail (Figure 6, right) networks, we clearly notice a glaring complementarity between the two modes (even considering the different scales of representation, the first showing weekly services the second daily ones). While rail transport is clearly focused on high and very high density relations, coach transport is focused on rural or peripheral regions. Consequently, until now, there is very limited competition between the two modes, except very peculiar routes (e.g. Milan – Puglia region). If liberalisation effects will fully deploy in the future, coach services might be able to become a competitor of rail on some routes, relying on higher land coverage and lower fares though penalised by higher travel times (even if competitive on a door-to-door basis for many minor origin-destination couples). In particular some relations appear as missing rail links, thus possibly more profitable for coaches: from the Ligurian and Thyrrenian coast to the northern/central Adriatic coast; from Sicily to the Ionian coast and internal connections along the Appenines.

National air transport grew fast in the last decade, reaching almost any part of the country with low fare services (Redondi et al., 2011; Salanti et al., 2012). However, as Figure 6 (left) shows, land coverage is still limited and almost no connections exist within the North (apart from infrequent Milan-Trieste and Genoa-Venice pairs), among cities on the Adriatic coast and among Sicily, Calabria, Basilicata and Puglia: those missing links might represent potential markets for competitive long distance coach services.



Figure 3 – Representation of long distance coach service flows in Italy (weekly services, April 2013). Seasonal services not included.



Figure 4 – Representation of long distance coach services and stops in Italy (weekly services, April 2013). Seasonal services not included.



Figure 5 – Representation of long distance coach service flows and population density in Italy (weekly services, April 2013). Seasonal services not included.

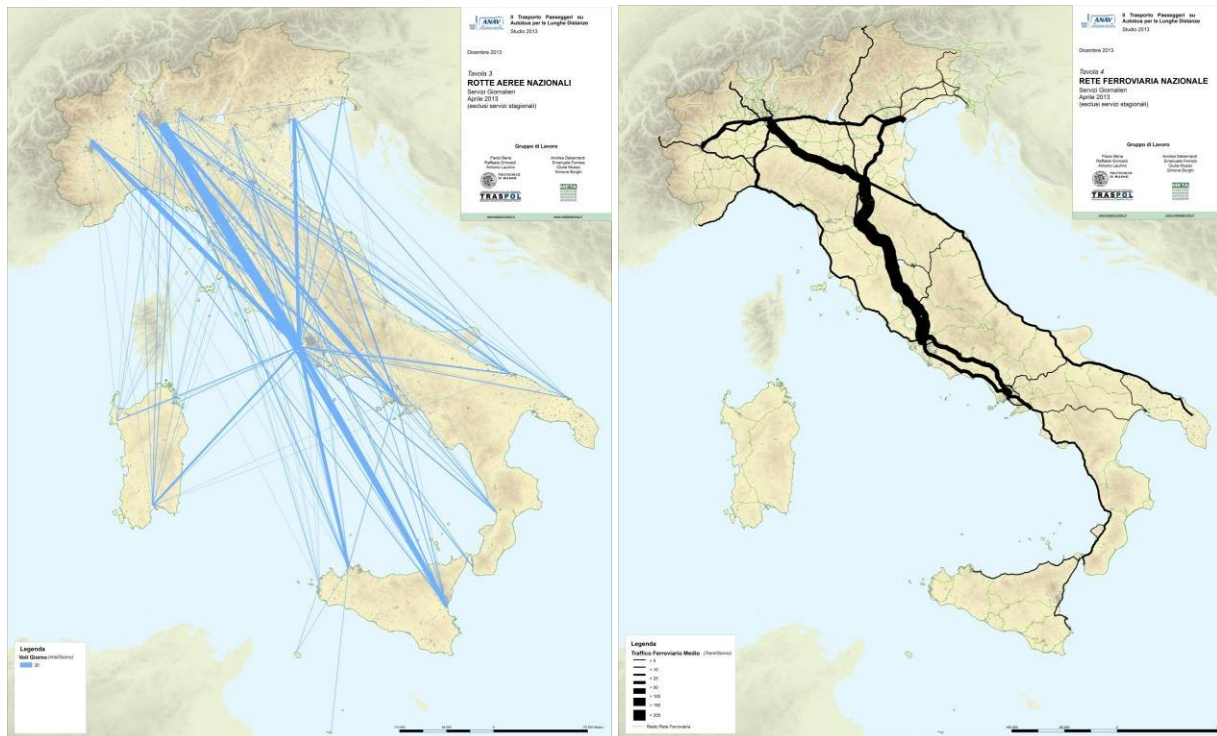


Figure 6 – Representation of national air (on the left) and long distance rail (on the right) transport supply in Italy (daily services, April 2013).

5. Spatial analysis of potential markets

In addition to the considerations emerged from the analysis of competing modes in the former section, we perform a more detailed spatial analysis of current supply, to evidence missing connections and possible potential markets.

In Figure 7, Figure 8 and Figure 9 we represent the already defined sub-Provincial Italian zones (see Figure 1 in section 3) with respect to three selected areas: Rome, region Veneto and the Higher Tyrrhenian area. The colours of the zones of the rest of the map represent the existing services to and from the selected area, in particular:

- the grey zones are already served by an existing long distance coach service to/from the selected area;⁷
- the red ones are already served by a direct long distance rail service (but not by a coach one);⁸
- the green ones are not served by any direct long distance service.

The density of population is represented by the density of the colour.

In particular, Figure 7 represents the connections of Italian zones with respect to the Capital city and confirms how Rome and Southern Italy are well connected by coach services. The biggest northern cities are already connected by rail services, but there exist many medium to high density areas in the north are not directly connected (in particular Bergamo, Brescia, the metropolitan area between Pisa and Florence, the metropolitan area north of Milan, the metropolitan area around Turin, and the lower Pianura Padana). In all

⁷ Bus services connecting two regions only are not included here as they do not belong to the long distance category, however they should obviously be taken into account when considering new markets for coach services (a fortiori because the regional concessions regulating those services usually grant them exclusivity on the origin-destination pair).

⁸ Although the indication that a zone is not directly connected via train to one another is not obviously sufficient to suggest that a train trip is not convenient, interchanges usually make rail transport relatively less competitive.

these cases frequent regional services connect the nearest metropolitan area (Milan, Verona, Florence, basically), but the millions of inhabitants of these areas have no long distance direct services to Rome.

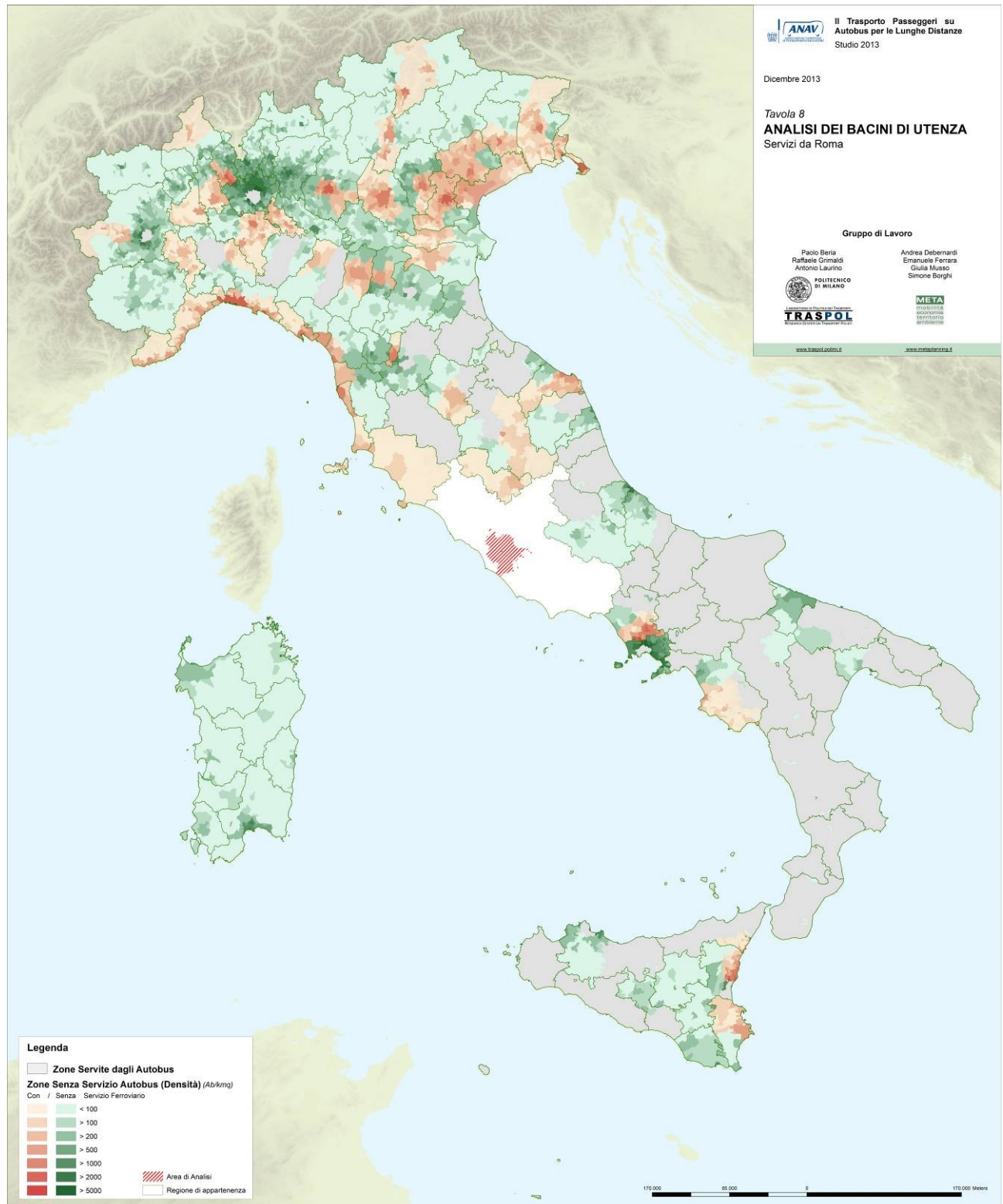


Figure 7 – Area analysis with respect to Rome (red dashed).

Grey areas already served by existing coach services; red area served by direct long distance rail services; green areas not directly served. Density of population represented by density of colour.

Figure 8 represents Italian zones with respect to the region Veneto and confirms that it is served only by a few coach services, mainly towards Calabria. More surprising is probably the fact that also direct rail

services are very few, namely towards the Adriatic coast, Milan, Turin, Rome, Florence and Naples. Huge areas of the country have no direct connections with the important and economically lively region, e.g. rest of Lombardy, Piedmont, the metropolitan area between Pisa and Florence, the Apennines. Veneto indeed seems to be a promising market for new direct coach services.

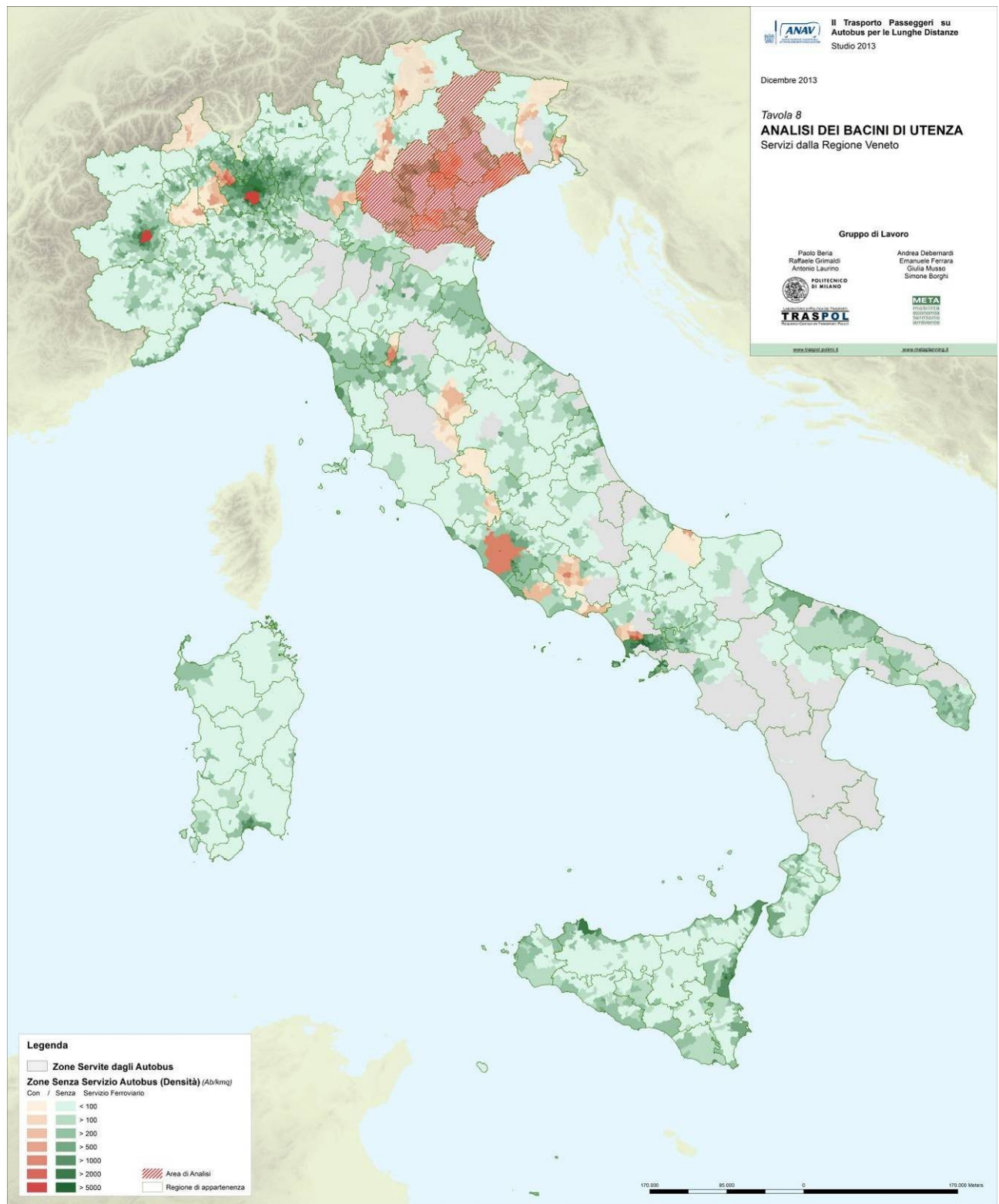


Figure 8 – Area analysis with respect to Veneto (red dashed).

Grey areas already served by existing coach services; red area served by direct long distance rail services; green areas not directly served. Density of population represented by density of colour.

Figure 9 represents Italian zones with respect to the Higher Tyrrhenian area.

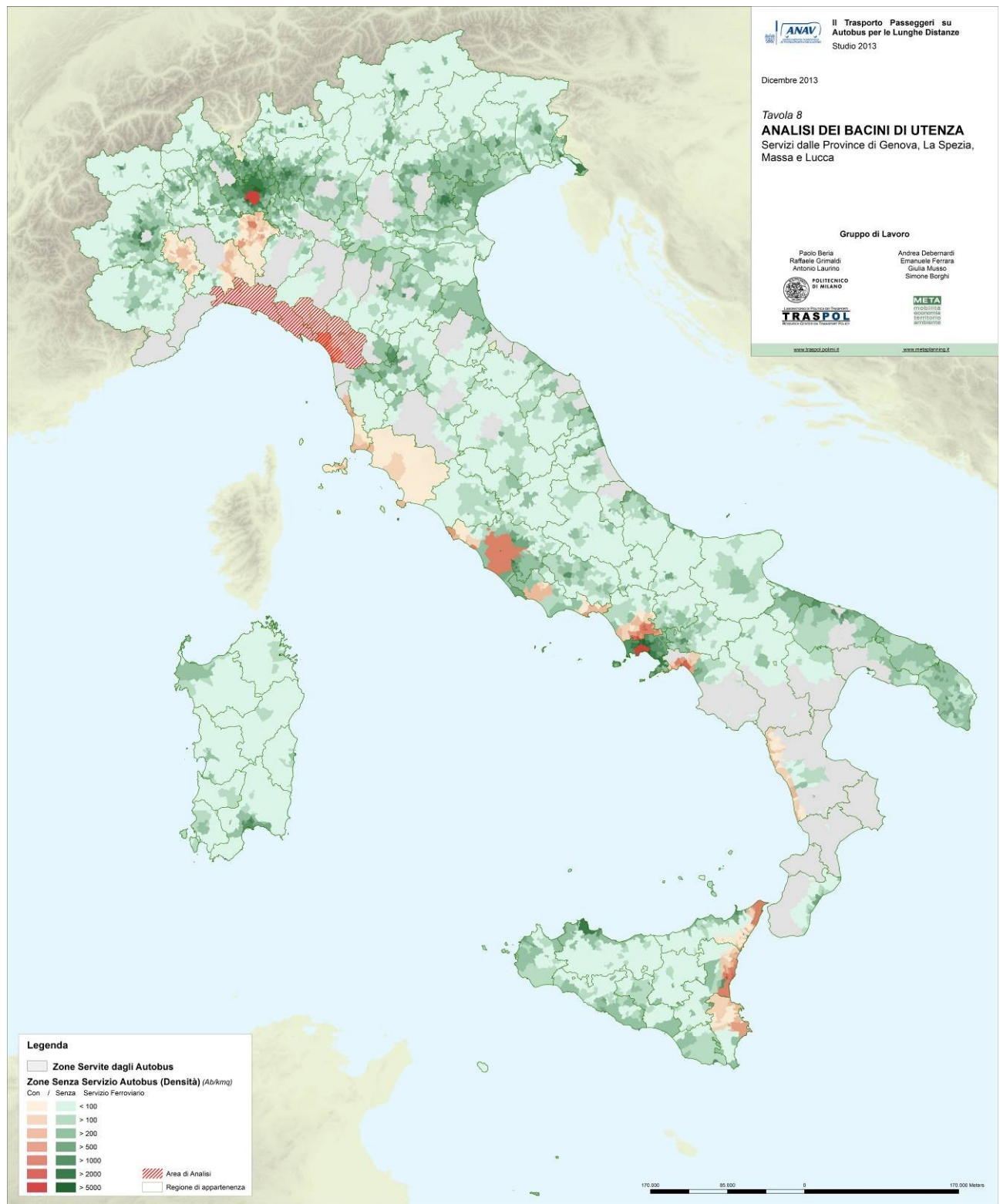


Figure 9 – Area analysis with respect to the Higher Tyrrhenian area (Provinces of Genova, La Spezia, Massa-Carrara and Lucca). Grey areas already served by existing coach services; red area served by direct long distance rail services; green areas not directly served. Density of population represented by density of colour.

This area is served only by a few coach services, again mainly towards Calabria. Rail services exist limitedly to Milan, Turin, Rome and Napoli; only recently a new service to Florence was introduced. Moreover, many of those services are subsidised within the Contract of Service between the Ministry of

Transport and Trenitalia and their existence in the future is precarious. No direct connections exist to rest of Lombardy and Piedmont, to Puglia, Veneto (even Venice) and Romagna area. Many potential relations seem thus to be suitable for new coach services.

6. Scenario analyses

In this section we perform scenario analyses on coach transport market. The 371 sub-Provincial zones already illustrated in Figure 1 generate $(371 \times 371) = 137,641$ origin-destination pairs. Of these, there are around 88,000 between non-neighbouring regions which represent the potential core market for long distance coach services. It is worth noticing that among these pairs, some are huge (e.g. Milan with Naples), others are irrelevant relations between inhabited and far zones.

Relations	Total	Served by coach services	%
Internal	9,655	2,356	24%
Between neighbouring Regions	26,848	5,297	20%
Between non neighbouring Regions	88,430	20,508	23%
To and from Sardinia	12,708	0	-
TOTAL	137,641	28,161	

Table 3 - Italian origin-destination pairs served by coach services (our elaboration , 2013 data).

We generated the generalised costs of trips from each zone to any another, three user profiles (*business*, *economy* and *family*) having different values of travel time, private car availability (and consequent related marginal costs), size of the travelling group and average stay in the place of destination.

Transport mode	Business	Economy	Family
Private car	7,456	1,351	10,791
Airplane	11,778	16,211	8,655
Rail	1,159	2,519	950
Coach	115	427	112
TOTAL	20,508	20,508	20,508

Table 4 - Origin-destination pairs belonging to non neighbouring Regions, for different users' categories and classified in terms of cheapest (i.e. lower generalised cost) transport mode (our elaboration , 2013 data).

The analysis of generalised costs per users category shows that coach transport is already the most convenient mode of transport for *economy* users on 2.1% of Italian origin-destination pairs: those origin destination pairs are represented in Figure 10 (top left). Those pairs include long relations between the South and Centre having bad train or air connections, few relations between the North and the South having low rail accessibility. Coach transport is almost never the most convenient mode of transport for trips among big cities or among short routes, even if absolute numbers might be high on those relations (e.g. a bus between Milan and Rome, while irrelevant in terms of share with respect to train and airplane, could serve hundreds of passengers per day among the thousands travelling everyday).

In the first scenario, in Figure 10 (top right), we **simulate the effect of an increase in flight prices**, pointing out the origin-destination pairs on which coach services' market shares would increase of at least 10% as a consequence of a 15€ increase on all flight prices. The relations on which coach services prove to be more positively sensitive to changes in flight prices are those within the South (in particular, relations among Puglia and Sicily) and those among the South and the Centre. Coach services among the North and the South seem to be less sensitive to such a change.

In the second scenario, in Figure 10 (bottom left), we simulate **the effect of an increase in private car fuel prices**, representing origin-destination pairs on which coach services' market shares would increase of at least 5% as a consequence of a 20% increase in private car fuel prices. In general coach services are less sensitive to private car fuel prices than to flight prices, however there would be an increase on relations among the North-West and the South-East, relations within the central Apennines. On the Tyrrhenian coast and on very long distance relations (e.g. towards Sicily) the impact would be very limited.

In the third scenario (Figure 10, bottom right), we simulate the **introduction of new virtual direct coach services among all non connected origin-destination pairs**. The most promising relations appear to be those among the Centre and the North-East, with a polarisation on urban areas having limited rail services (e.g. Bassano del Grappa, Udine, Urbino, Città di Castello, Foligno, etc.). Since most of those O-D pairs would obviously generate small absolute numbers, new services should clearly gather them in lines.

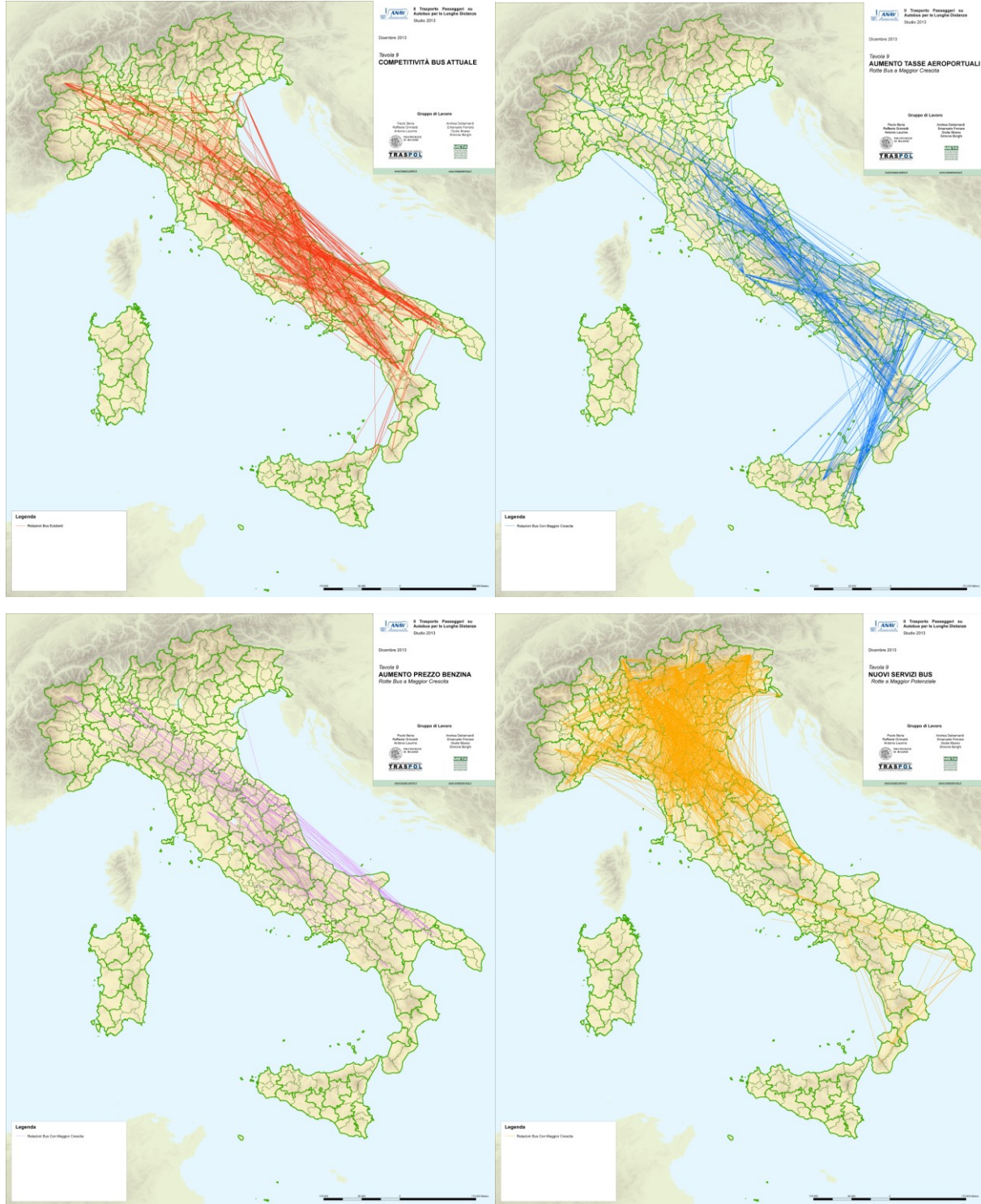


Figure 10 - Representation of origin-destination pairs on which: coach services is on average the most convenient mode of transport for 'Economy' users (top left); coach services' market shares increase (+10%) as a consequence of a 15€ increase on all flight prices (top right); coach services' market shares increases (+5%) as a consequence of a 20% increase in fuel prices (bottom left); new coach services would present the best potential (bottom right) (our elaborations, 2013 data).

7. Final considerations

Long distance coach transport in Italy is facing radical changes in the next years. The industry supplied more than 88 million bus-km in 2012, serving more than about 2.6 billion passenger-km. The existing network, providing a particularly extensive service in the South and in the Centre, directly serves 2/3 of Italian population.

However, new opportunities are arising. Firstly, the industry was completely liberalised in 2013, changing from an exclusive concessions regime to an open one, based on non-exclusive authorisations.

Other opportunities arise from changes in competing modes, in particular long distance railway services, whose quality generally improved, but together with an increase in prices for users (even though sharp discounts are offered by more advanced yield management systems). Our model confirms that coach services are particularly sensible to changes in the competing public transport modes and in particular to their fares. Competition with private transport appears instead more limited and users travelling alone with limited willingness to pay still represent the core business of coaches, while business users and families are more difficult to catch (for different reasons).

Moreover, parts of the country, probably considered not apt for coach services in the pasts, have changed their characteristics and might represent new opportunities too. For example, in consequence of more recent national migration not served by historical lines, the more significant probably being Veneto.

Coach services are now serving only 27,000 origin-destination, including indirect connection, out of about 115,000 formally allowed and many relations, also very important in absolute mobility terms, are still unexplored and left to competing transport modes. Our model indicates that the most promising relations for possible new services appear to be those among the Centre and the North-East of the country, with a polarisation on urban areas having limited rail services.

8. References

- Augustin, K. (2013). *Contestability of the German long-distance coach market*. European Transport Conference 2013.
- Beria, P., Grimaldi, R. & Laurino, A. (2012). *Il trasporto passeggeri su autobus per le lunghe distanze. Confronto modale, benefici e prospettive future*. Report, prepared by Politecnico di Milano on behalf of Associazione Nazionale Autolinee Viaggiatori (ANAV).
- Beria, P., Grimaldi, R. & Laurino, A. (2013). Long distance coach transport in Italy: state of the art and perspectives. *General proceedings of the 13th World Conference on Transport Research*. 15-18 July 2013. Rio de Janeiro, Brazil.
- Renato Redondi, Paolo Malighetti, Stefano Paleari (2011). New routes and airport connectivity. *Networks and Spatial Economics*, vol. 11, 4, p. 713-725.
- Salanti Andrea, Paolo Malighetti e Redondi Renato (2012). Low-cost pricing strategies in leisure markets. *Tourism Management*, vol. 33, 2, p. 249-256.
- Van de Velde, D. (2009). *Long-Distance Bus Services in Europe: Concessions or Free Market?* (No. 2009/21). OECD Publishing.